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NAVY'S LESS-THAN TRUCKLOAD COST FACTORS

by

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June 1996

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Working with the FINS data to determine how the summarized data was prepared, numerous questions concerning input, procedures, and data manipulation led to questions of data validity. During the sample period, more than 50% of the Navy's LTL shipments were carried by QUICKTRANS, and not considered by the FINS data. Navy users of FINS data should be aware of its limitations.

The FINS data indicated the Navy's higher LTL costs may be attributed to a higher percentage of ammunition and explosive shipments than the other services. Additionally, it was found that the Navy utilized the guaranteed traffic program far less frequently than DLA. Factors including weight, distance, and rates were also explored.

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NAVY'S LESS-THAN TRUCKLOAD COST FACTORS

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ABSTRACT

Historically the Navy's less-than-truckload transportation costs have been higher than DLA and the other Armed Services according to Military Transportation Management Command's (MTMC) Financial Information System (FINS) data. A sample of the FINS database was analyzed attempting to isolate factors causing the Navy's higher costs.

Working with the FINS data to determine how the summarized data was prepared, numerous questions concerning input, procedures, and data manipulation led to questions of data validity. During the sample period, more than 50% of the Navy's LTL shipments were carried by QUICKTRANS, and not considered by the FINS data. Navy users of FINS data should be aware of its limitations.

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I. INTRODUCTION

Data indicate that the U.S. Navy's less-than-truckload (LTL) costs are consistently higher than the Army, Air Force, or Defense Logistics Agency. The Naval Supply Systems Command, (NAVSUP) Code 44 has been interested in this phenomenon for several years. This thesis attempts to identify factors which may be contributing to those higher costs.

In the recent past the Navy had noted that its shipping costs were higher, but had not been overly concerned. However, in today's era of severe manning and funding cutbacks, it is necessary to identify those factors contributing to higher costs and attempt to minimize them.

The research for this project began with a literature review, which turned up little on the specific topic, but pointed toward some related information and provided valuable contacts. Interviews with persons involved in all phases of military transportation have provided insight into the process and many possible explanations for the Navy's higher costs. The primary research effort has been an analysis of a sample of more than 19,000 records extracted from the Financial Information System (FINS) database.

Data analysis reveals that the Navy ships ammunition and explosives and uses protective services far more frequently than other agencies. That use of protective services along with the elevated freight rates for those commodities requiring protective services are major contributors to the Navy's higher costs. Additionally, the Navy uses the Guaranteed Traffic program much less frequently than DLA, which also leads to higher costs.

A. BACKGROUND

The Navy, and other agencies, depend on data provided by the U.S. Army's Military Transportation Management Command (MTMC) in the form of monthly, quarterly and yearly summaries covering various modes of transportation, within the continental U.S. (CONUS) which are covered by government bills of lading (GBL). MTMC compiles these summaries utilizing the data in their Financial Information System (FINS) database.

Regular summaries provided by MTMC constantly reminded the Navy that only the Marine Corps experienced higher less-than-truckload shipping costs. (Lambert, 1993) In FY93 the Department of Defense bought 1.4 million miles of second destination[1] shipments, within CONUS, costing $632 million. DLA was by far the largest shipper, accounting for over 65.7% of all shipments. The Air Force, Navy, Army, and Marine Corps accounted for 14.3%, 10.8%, 8.5%, and 0.7% respectively. Of all Navy shipments, 69% fell into the Motor Freight, less than 10,000 pounds category, also referred to as Less-Than-Truckload (LTL).

The FY93 summary reported average LTL costs, in dollars per ton/mile, as follows:

DOD Average	.2991
DLA	.2720
Air Force	.2864
Army	.3252
Navy	.3760
Marine Corps	.4308

[1]Second destination, as well as other terms are defined in the Appendix.

With LTL costs 38% higher than DLA's and 15% higher than the Army's, the Navy would like to determine its cost factors, and if appropriate, attempt to reduce the cost factors which are forcing the average LTL cost to be higher than other agencies.

B. LITERATURE REVIEW

A literature review yielded little in the area of interest. Numerous recent papers have been completed on various types and elements of transportation costs. However, nothing was found comparing similar costs among agencies. The most useful studies were conducted for DLA, where comparisons were made among DLA depots.

A 1987 paper, Motor Carrier Cost Per Mile Analysis (Elliott, 1987), provided a useful format for comparison of cost, weight, and mileage. The findings of that study also provided a reality check for the current research findings. Also, 1986 and 1991 studies assessing DLA's costs and benefits of their guaranteed traffic program provided additional insight.

By chance the researcher interviewed a NAVSUP employee who was familiar with the question.[2] Mr. Gribble, NAVSUP 44A3, had originally posed the question and had worked with an Industrial College of the Armed Forces student on this same question in 1988. He provided a copy of the unpublished paper completed that year (Munro, 1988). Unfortunately, that author was unable to actually perform any analysis, and only wrote of how he might approach the investigation. The paper

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[2]The researcher's point of contact at NAVSUP had been Mr. John Lambert. Mr. Lambert left NAVSUP during the fall and no direct replacement was named. The researcher was told by Mr. Lambert's former supervisor, CDR Butherus, that no one would be replacing Mr. Lambert. Furthermore, the office was over burdened, and any further requests would have to be cleared through himself. A helpful researcher at DLA provided a contact at MTMC who provided the name of a NAVSUP contractor who finally provided the name of a NAVSUP contact familiar with the research question, Mr. Gribble at NAVSUP Code 44A3.

became available after most of the analysis had been completed on the current project, so suggestions did not affect the current research.[3]

C. METHODOLOGY

Throughout the research period, transportation personnel were interviewed and asked if they had any ideas why the Navy's LTL costs were higher than other services. It seems that everyone had a response. Certainly some were more grounded in experience, while others seemed to reflect interservice rivalries. Some of these suggestions, along with the researcher's own thoughts, were translated into hypotheses or questions which might be tested on the 19,128 record sample of the FINS database. Utilizing a 486DX2-66 desktop computer running Paradox for Windows version 4.5 software, queries and analysis were designed to test the hypotheses.

D. ORGANIZATION

In Chapter II the FINS database is discussed with some detail on its shortcomings, followed by a discussion of the sample data used in this research. The Chapter closes with a glimpse at the future with Consolidated Freight Management (CFM).

Chapter III is subdivided into several sections. In each section a question or hypothesis is introduced and discussed, followed by a commentary on the database queries, presentation of the actual results of the queries, and the researcher's analysis of the data queries.

The final chapter summarizes the findings and draws conclusions. Additionally, recommendations are made for possible changes, and areas of further related research.

Definitions for terms used in this thesis are found in the Appendix.

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[3]In fairness to the prior research it must be pointed out that the earlier researcher did not have the ability to perform his own analysis, and had to depend on MTMC for data queries.

II. DATA

The Financial Information System (FINS) database has evolved over the years and data elements have changed with time. The configuration has been stable since September 1989 and consists of 364 columns. (Meyers, 1993) Table 1 defines the positions and data.

Table 1. FINS Record Layout

CC	Item		CC	Item
1	Record type		245	Type rate
2-9	GBL number		246-251	Carrier received date
10-15	NMFC		252-257	Carrier delivery date
16	NMFC sub		258-259	Destination state
17-18	Kind of packages		260-265	Destination city
19-32	blank		266-274	Destination SPLC
33-38	Line item rate		275	Protective service code
39-87	blank		276-279	Protective service charge
88-95	Voucher number		280-293	blank
96-101	Date paid		294-299	Estimated charges
102-105	Payee code		300-305	blank
106-109	origin carrier		306	Billing unit
110-119	Route order number		307-314	Cross reference GBL
120-121	Transport method		315-323	blank
122-131	blank		324	World wide code
132-133	Origin state		325	Locator code

Table 1 (Continued)

CC	Item		CC	Item
134-139	Origin city		326	Origin GEO area
140-148	Origin SPLC		327	Destination GEO area
149-152	Origin GBLOC		328-330	Mile factor
153-156	Destination GBLOC		331-341	Ton-miles
157	blank		342	Comm GRP code
158	Type movement		343	DOD component
159-182	Participating carriers		344-347	Process date
183-184	Appropriation code		348	Payee mode
185-194	Total weight		349	Foreign move
195-204	Billed weight		350	Service center
205-209	Total cube		351	Duplicate record
210-217	Total paid charges		352	Carrier mode
218-224	Total line haul charges		353	QPR
225	Full load ind		354	Weight check
226-228	Number of loads		355-364	Miles calculation
229	Reason for high cost			
230-234	Cost difference			
235-244	Special rate authorization			

The FINS database provides extensive data, but the data is only of fair quality. Fields such as the GBL, originating state and destination state, total weight, and total cost, National Motor Freight Classification, (NMFC), mode of shipment, and

appropriation are all required fields, and should be fairly reliable. Most of the other fields are optional, and the record will process in the FINS data base without these "optional" fields being completed.

Beyond those mandatory fields, the quality of the data is more dependent upon both the person originally preparing the paper GBL and the person who inputs the data from the paper GBL into an electronic format at the paying activity. Discussions with individuals involved with the data input for the Navy indicate that quality and completeness of input was not a priority, and that input quality varied greatly depending on work backlogs. Supervisors were often more concerned with getting the work cleared, than accuracy or completeness of the FINS data.

Beyond questionable input quality, it was discovered that the large percentage of Navy LTL traffic which traveled in the QUICKTRANS system was accounted for within its own database. (Bialas, 1994) The QUICKTRANS database did not provide data for FINS. Therefore, ConTruck and Northeast Dedicated Truck service data was not considered in the FINS reports.

The interstate distance or mileage used by FINS is not the actual distance from the origin to the destination. FINS assigns "mileage factors" (MF) by looking at the origin and destination states, then looks up the midpoint state-to-state distance on a distance table and assigns a mileage factor rounded to 100 mile increments to each record. (Meyers, 1993) 100 miles is the minimum distance reported as a MF of one. For example, trips from anywhere in Florida destined for anywhere in Virginia are assigned a distance of 800 miles regardless of actual distance.

Intrastate distances are also looked up on tables which provide a mileage factor for all intrastate shipments. Again the same distance, in 100 mile increments, is assigned to all shipments within a state whether the shipment is across town or the entire length of the state. Therefore, a five mile shipment from Norfolk to Portsmouth

is credited as 100 miles while a 189 mile shipment from Norfolk to Quantico is also credited that same 100 miles.

A distance table based on the Standard Point Location Code (SPLC) is available to FINS. The SPLC table provides accurate distance information between specific origins and destinations, but it is dependent upon accurate input of the SPLC fields. Unfortunately, more than 15 % of the records have one or both fields missing or incorrect. Therefore, the state midpoint tables are used in all standard reports, as well as this research. (Stegall, 1994)

An important statistic reported by FINS is cost per ton-mile, which is calculated by summing all costs and dividing by the sum of ton-miles. Ton-miles are calculated in FINS by taking the shipment weight in pounds then dividing by 2000 to get the weight in tons. Next, the tons are multiplied by the mileage factor x 100. The product is divided by ten and reported in whole numbers as tens of ton-miles. The mileage factor (MF) is reported in FINS rounded to the nearest 100 miles with the last two zeros dropped. Thus, 1258 miles is reported as a MF of 13. Note that the preceding method causes small weight (less than ten pounds) or short distance shipments to be calculated as zero ton-miles. In the sample data base, described below, nearly 10 percent of the records were assigned zero ton-miles.

At some point the question becomes obvious: If the FINS database is suffering from questionable input quality and output tainted by questionable data manipulation, why is the Navy using the data or concerned with the output? Unfortunately, the answer is that the Navy has no comprehensive data gathering tool of its own. It must accept the FINS output, and many Navy users of FINS data are not fully aware of its shortcomings.

Possibly, hope is on the horizon. With the full implementation of the CONUS Freight Management system (CFM), FINS will be replaced, and quality data will be

collected. In January 1994 CFM began tests at DLA depots, and the program office expected installations to be completed DOD-wide, by the end of FY96. However, the FY96 estimate may be optimistic since the Navy has invested its resources exploring alternatives to CFM, instead of preparing to link into the system. CFM, utilizing EDI technology, will track every GBL from initial creation through payment and database filing. Most data will be input once only, upon GBL initiation. Due to edit checks built into the real-time system it will be difficult to get a GBL to process without complete and accurate input. However, CFM is the future and FINS is data that is available today.

THE SAMPLE DATABASE

At the onset of this research, it was hoped that analysis of individual records as well as groups of records might reveal trends leading to the Navy's higher LTL costs as reported by FINS. Early on it was realized that the FINS database is available for the past 12 years, with millions of records available. With such vast numbers of records available, and very limited computing resources, it was decided to extract a small sample of the LTL records for analysis.

The sample was actually drawn in early November 1993. At that time all the data for FY93 was scheduled to be available. Since it was desirable to limit the sample database to 25,000 records, a single month of data was selected. All Army and Navy LTL shipments made during June 1993 were selected. All the DLA LTL shipments during June totaled approximately 50,000. To limit the number of DLA records and still obtain a fair sample, five days were selected. The selected days were spread over the month and represented each of the regular five working days. Specifically, Wednesday June 2, Thursday June 10, Tuesday June 15, Friday June 25, and Monday June 28 were selected.

The selection factors were expected to yield approximately 7,500 Navy records, 4,500 Army records and 12,500 DLA records. However, only 3,754 Navy, 4,253 Army, and 11,408 DLA records were selected for a total of 19,415. The lower than expected selection rate was probably due to the failure to input pickup or shipping dates when the paper GBL was manually keyed into FINS.

The 19,415 records were visually screened for "appearance" validity. Since this inquiry is limited to CONUS LTL shipments, records involving shipments to Europe, Africa, and Asia were deleted, as well as shipments to Hawaii, Puerto Rico, Guam, and Alaska. Additional records were deleted which contained obvious, and gross, errors. The records actually used for the analysis numbered 19,128, consisting of 3698 Navy, 4146 Army, and 11284 DLA records. (It is interesting to note that all records are included in the preparation of the regular FINS reports.)

The assumption is made that inferences drawn from the data sample will hold true for the entire fiscal year. Furthermore, it is assumed that reasonable conclusions may be drawn comparing the sample Navy records to the sample Army and DLA records.

III. HYPOTHESES AND ANALYSES

In each of the following sections A through G, a hypothesis or idea is introduced, followed by a discussion of the hypothesis, if appropriate. The data is then examined or tested, and frequently a table of the results is presented. Finally, where appropriate, the results are commented upon, and regression analysis statistics are presented.

Due to the types of data available and the tests performed, several units of measurement are utilized. In each of the sections the reader must be aware of the differences in tons, pounds, miles, mileage factors, and ton-miles.

A. SHIPMENT WEIGHT

The weight of the average Navy shipment is less than the average shipment weight of other agencies. Those familiar with shipboard operations are all too aware of the lack of storage space. This shortage of stowage along with the requirement to keep a tremendous number of items available, causes ships to order very small quantities on a frequent schedule. If analysis of shipment sizes confirms that Navy shipments are smaller than other agencies, then small size could be a contributing factor to higher cost.

The logic behind the above hypothesis is derived from typical LTL rate schedules. The following numbers are typical rates for general cargo commonly referred to as Freight, All Kinds or FAK, for LTL traffic between the San Francisco Bay Area and San Diego Area,[4] a distance of 486 miles.

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[4]Shipping rates were provided by MTMC-WA. The rates cited are for the low cost carrier during February 1994.

Shipment Weight in Lbs	Price
1 - 499	32.00
500 - 999	55.00
1000 - 1999	82.00
2000 - 4999	93.00

For example, if an afloat unit orders an item every week and that item weighs 100 lbs., then the shipping cost for a month would be 4 x 32 or $128. On the other hand, If the item were ordered just once for a shipment weight of 400 lbs., the total shipping cost would be only $32. Carried further, a single 4000 lb shipment would cost $93. However that same 4000 lbs shipped 100 lbs at a time would cost $1280.

The sample database was divided into DLA, Army, and Navy records, before further categorization. For each agency the shipments were placed into weight classes with the number and percentage of each calculated. Average weights were calculated for each weight category, as well as average cost. This is shown in Table 2.

Table 2. Shipping Weight Data (Lbs)

SHIPMENT WT	**DLA #**	DLA %	AVG $	AVG WT	TOT $
1 - 499	7744	68.63%	$54.37	149	$421,041
500 - 999	1236	10.95%	$108.21	702	$133,748
1000 - 1999	897	7.95%	$178.45	1405	$160,070
2000 - 4999	846	7.50%	$338.91	3153	$286,718
5000 - 9999	561	4.97%	$578.88	7349	$324,752
TOTAL	11284				$1,326,328
SHIPMENT WT	**ARMY #**	ARMY %	AVG $	AVG WT	TOT $
1 - 499	1695	40.88%	$178.19	223	$302,032
500 - 999	672	16.21%	$210.27	705	$141,301
1000 - 1999	547	13.19%	$368.06	1417	$201,329

Table 2 (Continued)

2000 - 4999	626	15.10%	$613.00	3212	$383,738
5000 - 9999	606	14.62%	$993.07	7442	$601,800
TOTAL	4146				$1,630,201
SHIPMENT WT	**NAVY #**	NAVY %	AVG $	AVG WT	TOT $
1 - 499	1651	44.65%	$185.85	188	$306,838
500 - 999	536	14.49%	$274.40	715	$147,078
1000 - 1999	489	13.22%	$384.01	1417	$187,781
2000 - 4999	592	16.01%	$777.42	3259	$460,233
5000 - 9999	430	11.63%	$1,228.46	7229	$528,238
TOTAL	3698				$1,630,168

Table 2 shows that DLA processes a higher percentage of lighter shipments, in all but one weight group, than the Army or Navy. The numbers might lead one to believe that smaller shipments were more economical, especially when the prices are compared among the three. In the under 500 lbs group DLA's average weight and cost were 149 lbs. and $54.37, while the Navy's were 188 lbs. and $188.85. However, that should not be the case. In shipping costs, economies of scale prevail. Therefore, other factors are influencing the Navy's higher LTL shipping costs.

Regression analysis was performed on the shipping cost and shipment weight data. Due to the size of the data base and the limitations of the software used for regression analysis, the regressions were run on four subsets of the data; Navy, Army, DLA1 and DLA2. The DLA data consisted of over 11,000 records, which were too many observations for the software to process, so it had to be divided. The DLA record division was based on shipping dates. DLA1 consists of June 10 and 28, and DLA2 consists of June 2, 15, and 25. Table 3 shows the regression statistics for shipment cost (dependent variable) versus shipment weight (independent variable).

Table 3. COST versus WEIGHT (LBS)
Regression Coefficients with (Standard Errors)

SAMPLE	INTERCEPT	SLOPE	R SQUARED
DLA1 4895 records	48.8 (2.97)	0.0723 (0.00153)	.313
DLA2 6389 records	50.8 (3.08)	0.0781 (0.00156)	.281
ARMY 4146 records	171 (11.5)	0.113 (0.00356)	.195
NAVY 3698 records	179 (14.8)	0.150 (0.00507)	.193

With the R squared calculations ranging from a low of .193 to a high of .313 the correlation is very low, indicating that the models (the fitted data) do not explain a large proportion of the variance in cost. However, since all the slope coefficients are significantly different from zero, shipment weight is a very (statistically) significant explainer of shipment cost.

B. SHIPMENT DISTANCE

The average Navy shipment is of a shorter distance than the average shipping distance of other agencies. As the distance of a shipment increases, the average cost per mile normally decreases. Thus, theoretically if all else is equal, the agency with the longest average shipping distance should have a cost advantage in the ton-mile cost calculations.

Logic suggests that most of the Navy's vessels and installations are clustered along the east and west coasts of the United States, and would be supplied by stock

points on the same coast. If the coastal argument is accepted, then it follows that most of the Navy's shipments would be along the coasts instead of cross country. Therefore, the Navy's coastal shipments may be of shorter mileage than those of other agencies not so closely tied to the oceans.

A popular rate offered for FAK shipments at the minimum weight class is $39.00 to any location served in the CONUS by the motor freight company. In the sample database over 1600 records were billed at the $39.00 charge. This $39.00 rate covered shipments between 15 miles and 2846 miles. The 15 mile trip cost $2.60 per mile while the 2846 mile trip cost only $.0137 per mile.

Queries of the sample database yielded some surprising results. Instead of the Navy's average shipment distance being shorter, the Navy's were slightly longer than either the Army or DLA shipments. This is shown in Table 4.

Table 4. Shipping Distances and Calculated Data

	DLA	ARMY	NAVY
RECORDS #	11284	4146	3699
TOT COST	$1,326,323.73	$1,630,192.97	$1,631,027.49
AVG COST	$117.54	$393.20	$440.94
TOT WT	10077871	8147447	6425888
AVG WT	893.11	1965.13	1737.20
TOT TONS	5038.94	4073.72	3212.94
TOT MILES	11999500	4607400	4657500
AVG MILES	**1063.41**	**1111.29**	**1259.12**
TON-MILES	5358446.17	4527079.99	4045495.18
$ PER TON-MILE	$0.2475	$0.3601	$0.4032

Average mileage for all weight classes of LTL shipments for the DLA, Army, and Navy were 1063, 1111, and 1259 respectively. It appears that short hauls are not a dominant factor contributing to the Navy's higher LTL costs. The numbers suggest

the Navy should be helped by longer average distances driving down the per mile cost.

Regression analysis was performed on the shipping cost and shipment distance data. Due to the size of the data base and the limitations of the software and computer, the regressions were run on four subsets of the data. The regression statistics for shipment costs (dependent variable) versus shipment distance (independent variable) are shown in Table 5.

Table 5. Cost Versus Distance Regression Coefficients with (Standard Errors)

SAMPLE	INTERCEPT	SLOPE	R SQUARED
DLA1 4895 records	87.6 (4.97)	2.35 (.361)	0.00857
DLA2 6389 records	88.4 (5.10)	3.10 (.363)	0.011
ARMY 4146 records	148 (15.9)	22.0 (1.14)	.195
NAVY 3698 records	237 (19.6)	16.2 (1.17)	0.049

The above R squared statistics indicate distance accounts for only a small proportion of the variance in cost. Once again, however, we see that shipment distance is a very (statistically) significant explainer of shipment cost.

C. COMMODITY TYPE

<u>Certain commodities, or concentrations of certain commodities among the distinct agencies effect the average freight rates more adversely for one agency than</u>

the others. For example, shipping hazardous material (HAZMAT) is much more costly than shipping FAK. It is possible that the Navy has more HAZMAT shipments than the other agencies.

A review of the sample database reveals the shipments have been made under 24 different commodity codes. Table 6 shows the breakdown.

Table 6. LTL Shipments by Commodity Percentages by Agency

COMMODITY							COMMODITY
CODE	DLA #	ARMY #	NAVY #	DLA %	ARMY %	NAVY%	
3	9	46	37	0.1%	1.1%	1.0%	ORDNANCE
4	0	3	1	0.0%	0.1%	0.0%	MIL IMPLEMENT
6	0	13	3	0.0%	0.3%	0.1%	AUTOMOBILES
9	53	138	3	0.5%	3.3%	0.1%	UNIDENTIFIED
A	276	0	5	2.4%	0.0%	0.1%	PERISHABLE SUBSISTENCE
B	29	0	2	0.3%	0.0%	0.1%	PETROLEUM PRODUCTS
C	**90**	**355**	**448**	**0.8%**	**8.6%**	**12.1%**	**AMMO & EXPLOSIVES**
D	21	1	0	0.2%	0.0%	0.0%	VEHICLE PARTS
E	43	12	17	0.4%	0.3%	0.5%	MACHINERY & PARTS
F	5	5	34	0.0%	0.1%	0.9%	AIRCRAFT PARTS
G	73	0	6	0.6%	0.0%	0.2%	PROVISIONS
I	154	1	1	1.4%	0.0%	0.0%	IRON OR STEEL ARTICLES
K	3	79	2	0.0%	1.9%	0.1%	NON MOTORIZED VEHICLES
L	2	38	2	0.0%	0.9%	0.1%	FREIGHT VEHICLES
M	1	4	0	0.0%	0.1%	0.0%	MOTOR VEHICLES
N	1	229	4	0.0%	5.5%	0.1%	PRINTED MATTER
P	84	40	105	0.7%	1.0%	2.8%	ELECTRICAL EQUIPMENT
Q	1	5	0	0.0%	0.1%	0.0%	FURNITURE
R	10	0	5	0.1%	0.0%	0.1%	CONTAINERS
S	9899	3132	2960	87.7%	75.5%	80.0%	MISC.
T	17	0	5	0.2%	0.0%	0.1%	GASES
U	211	3	28	1.9%	0.1%	0.8%	CHEMICALS
W	4	1	30	0.0%	0.0%	0.8%	ENGINES
X	298	41	0	2.6%	1.0%	0.0%	MULTIPLE COMMODITIES
TOTAL	11284	4146	3698				

Codes for gases, chemicals, ordnance, and ammunition & explosives signaled possible costly commodities due to special shipping and handling requirements. Summing the percentages of these commodities by agency yielded:

DLA	3.0%
Army	9.9%
Navy	14.0%

Noting the Army's more than three times and the Navy's nearly five times the DLA percentage of shipments in these categories signaled an area for further investigation.

Reviewing the database and querying for the specific commodity codes revealed that gases had only one very expensive record out of 21. Chemicals revealed only six costly records out of 249. Ordnance, however, sparked interest as it revealed that almost half of the 100 records had total charges equaling several times the average cost. And finally the ammunition and explosives category consisted of 893 records with most of them costing several times the average. Additionally, many of the expensive ordnance records and nearly all the ammunition and explosives records included protective services charges.

D. SHIPPING RATES

<u>Shipping rates for commodity code C, ammunition and explosives are costly enough that even a small percentage of these shipments skew the average cost.</u> The Special Commodity Branch at MTMC Western Area, was requested to provide some sample rates for various sized LTL shipments of ammunition and explosives, with protective services. As a comparison MTMC was asked to also provide rates for similar sized shipments of FAK, both with and without protective services. Tables

7 and 8 show the various requested rates. The rates shown are the low tariff on file at MTMC on February 3, 1994.

Table 7. Norfolk, VA to Seal Beach, CA - 2681 Miles

COMMODITY	AM/EX	FAK	FAK	FAK	FAK
PROTECTIVE SVS	DN/SM	CSS	NONE	NONE	NONE
MODE	VAN	VAN	VAN	VAN	VAN
CARRIER	KNTL	KTXI	ODFL	ODFL	ODFL
WEIGHT	100	100	100	1000	2000
MAX WT SAME $	40000	499	499	1999	4999
FREIGHT $	$3,286	$111	$59	$132	$230
DUAL DRIVER $	$1,104				
SATELLITE SERV $	$607				
CSS $		$400			
TOTAL	$4,997	$511	$59	$132	$230

Table 8. Concord NWS, CA to North Island, CA - 486 Miles

COMMODITY	AM/EX	FAK	FAK	FAK
PROTECTIVE SVS	DN/SM	CSS	NONE	NONE
MODE	VAN	VAN	VAN	VAN
CARRIER	RNGR	CWWE	CWWE	OVNT
WEIGHT	100	100	100	1000
MAX WT SAME $	40000	499	499	1999
FREIGHT $	$816	$32	$32	$82
DUAL DRIVER $	$260			
SATELLITE SERV $	$160			
CSS $		$267		
TOTAL	$1236	$299	$32	$82

As can be seen, the differences in rates are tremendous. The lowest quote for the 2681 mile Norfolk VA to Seal Beach CA, 100 lbs, ammunition shipment with protective services is just under $5,000. A 100 lb shipment of FAK making the same trip had low quotes of $511 with protective services and only $59 without protective services. For the same type shipments of 486 miles from the San Francisco area to the San Diego area would be priced at $1,236 for the ammo, $299 for the protected FAK, and $32 for the unprotected FAK.

It should be noted that the quoted price for ammunition shipments is often for the entire van. Therefore, the agency shipping ammunition and explosives pays for the entire van whether shipping 50 lbs or an entire van load. (Morgan, 1994)

To test the theory that a small number of expensive shipments could have a significant impact on the averages, the sample database was queried as a whole, then queried with only the ammunition and explosive records selected, and finally queried with all records except the ammunition and explosive records selected. Table 9 indicates that indeed the expensive ammunition and explosive shipments have an inflating effect on the total or average cost. Less than 9% of the shipments account for almost 26% of the cost.

Table 9. Ammunition Shipment Comparison

	COUNT	TOTAL WT	TOTAL $	AVG WT	AVG $	% REC	% $
All Records	19,128	24,650,203	$4,586,691	1,289	$240	100.00%	100.00%
Rec w/o Ammo/Expl.	18,235	22,532,000	$3,397,518	1,236	$186	91.41%	74.07%
Only Ammo/Expl	893	2,118,203	$1,189,173	2,372	$1,332	8.59%	25.93%

E. AMMUNITION AND EXPLOSIVES

One agency is transporting a higher percentage of ammunition and explosives and is affected by the high cost of those shipments. The database was divided by

agency into three parts. Each agency was then evaluated for the effect of ammunition and explosive shipments on the agency's average costs. This evaluation was conducted by comparing each agency's data, first including the ammunition and explosives, and then excluding the commodity group C shipments.

Table 10 shows the average cost differences of the total sample database (ALL RECORDS), the ammunition and explosive shipments only (AMMO & EXPL ONLY), and finally the data base with all ammunition and explosive shipments removed (NO AMMO & EXPL). Note the last group of data, where the ammunition and explosive shipments are removed. It has a much lower ton-mile average, and the ton-mile rates are more closely grouped.

Table 10. Ammunition Versus Non-Ammunition Shipping Costs

DATABASE		SHIPMENTS	AVG $ CWT	AVG $ TON-MILE	AVG HAUL
ALL RECORDS	DLA	11284	$13.1607	**$0.2476**	1063
	ARMY	4146	$20.0086	**$0.3602**	1111
	NAVY	3698	$25.3733	**$0.4031**	1259
AMMO & EXPL ONLY	DLA	90	$59.4907	**$1.1970**	994
	ARMY	355	$59.1070	**$1.1444**	1033
	NAVY	448	$53.9027	**$0.9890**	1090
NO AMMO & EXPL	DLA	11194	$12.4520	**$0.2341**	1064
	ARMY	3791	$16.0571	**$0.2870**	1119
	NAVY	3250	$18.6961	**$0.2914**	1283

Regressions were run on the four sub-data bases with ton-miles as the independent variable and cost as the dependent variable. Tables 11 and 12 display the regression statistics. In Table 11 the regression statistics are grouped by agency. In Table 12 the regression statistics are grouped by types of data, specifically, all records

(ALL), all records except ammunition and explosives (NO "C"), and ammunition and explosives only ("C" ONLY).

Table 11. Cost Versus Ton-Miles
Regression Coefficients with (Standard Errors)

	SAMPLE / SIZE	INTERCEPT	SLOPE	R SQUARED
DLA1	ALL / 4895	60.0 / (2.69)	1.32 / (0.0241)	.381
	NO “C” / 4856	56.2 / (2.37)	1.26 / (0.0215)	.415
	“C” ONLY / 39	806 / (66.7)	2.51 / (.321)	.623
DLA2	ALL / 6389	63.0 / (2.80)	1.43 / (0.0246)	.345
	NO “C” / 6338	57.9 / (2.48)	1.39 / (0.0218)	.390
	“C” ONLY / 50	721 / (112)	4.14 / (.857)	.327
ARMY	ALL / 4146	182 / (9.51)	1.89 / (0.0413)	.337
	NO “C” / 3791	100 / (8.07)	1.09 / (0.0346)	.445
	“C” ONLY / 355	1047 / (46.1)	1.84 / (.240)	.143
NAVY	ALL / 3698	213 / (11.9)	2.26 / (0.0511)	.347
	NO “C” / 3250	136 / (9.59)	1.78 / (0.0450)	.326
	“C” ONLY / 448	979 / (46.2)	2.99 / (.135)	.523

Table 12. Cost Versus Ton-Miles
Regression Coefficients with (Standard Errors)

	SAMPLE / SIZE	INTERCEPT	SLOPE	R SQUARED
ALL	DLA1 / 4895	60.0 / (2.69)	1.32 / (0.0241)	.381
	DLA2 / 6389	63.0 / (2.80)	1.43 / (0.0246)	.345
	ARMY / 4146	182 / (9.51)	1.89 / (0.0413)	.337
	NAVY / 3698	213 / (11.9)	2.26 / (0.0511)	.347
NO "C"	DLA1 / 4856	56.2 / (2.37)	1.26 / (0.0215)	.415
	DLA2 / 6338	57.9 / (2.48)	1.39 / (0.0218)	.390
	ARMY / 3791	100 / (8.07)	1.09 / (0.0346)	.445
	NAVY / 3250	136 / (9.59)	1.78 / (0.0450)	.326
"C" ONLY	DLA1 / 39	806 / (66.7)	2.51 / (.321)	.623
	DLA2 / 50	721 / (112)	4.14 / (.857)	.327
	ARMY / 355	1047 / (46.1)	1.84 / (.240)	.143
	NAVY / 448	979 / (46.2)	2.99 / (.135)	.523

Table 12 indicates that not only are the Navy's ammunition and explosives shipments more expensive on a ton-mile basis than other agencies, but also its non ammunition and explosives shipments are more expensive on a ton-mile basis. Navy's average shipment is more expensive per ton-mile than DLA or Army.

Since ton-miles is a constructed variable using the mileage factor, discussed earlier, and since the rounding problem is present, the regression estimate for the DLA intercepts, because of its frequency of small shipments, are biased downward. Hence comparison of DLA to either Army or Navy is difficult.

While looking at Commodity group "C," ammunition and explosives shipments, the mode of shipment revealed that the Army and DLA utilized the

Dromedary mode far more frequently than the Navy. The other modes used were primarily van and flatbed. Table 13 shows the differences among agencies in dromedary usage.

Table 13. Dromedary Usage for Ammunition and Explosives

	DROM MODE	% DROM	AVG WEIGHT	OTHER MODE	% OTHER	AVG WEIGHT	TOTAL SHMTS
DLA	64	**71.11%**	1399	26	28.89%	2397	90
ARMY	222	**62.54%**	1556	133	37.46%	3025	355
NAVY	6	**1.34%**	177	442	98.66%	2754	448

Since a dromedary mode shipment does not utilize the entire load, as in a van shipment, the rates are much lower as can be seen in Table 14.[5]

Table 14. Yorktown, VA to San Diego, CA - 2636 miles
Commodity: Ammunition & Explosives

PROTECTIVE SVS	DN/SM	DN/SM	DN/SM
TYPE TRANSPORT	**FLAT BED**	**VAN**	**DROMEDARY**
CARRIER	RNGR	KNTL	CWWE
MAX WT SAME $	40,000	40,000	5,000
FREIGHT $	$3,351	$3,231	$1,048
DUAL DRIVER $	$516	$516	$163
SATELLITE SERV $	$597	$597	$353
TOTAL $	**$4,464**	**$4,344**	**$1,564**

DN = Dual Drivers SM = Satellite Surveillance

[5]Rates for various modes of service were provided by MTMC. Prices are for the lowest cost tariff on file for 3 February 1994.

For shipments of less than 5000 pounds, the dromedary appears to be the most economical mode. However, other factors such as volume and physical separation requirements must be considered. The transportation of ammunition and explosives, and weapons involves a myriad of Federal, State, locality, and agency regulations which are beyond the scope of this analysis.

F. GUARANTEED TRAFFIC

The use or non-usage of guaranteed traffic programs can greatly affect the various agencies' shipping costs. DLA commissioned a study using 1989 data and comparing Guaranteed Traffic rates to MTMC undiscounted baseline rates for LTL traffic. The study found that the guaranteed traffic rates were an average 30.6% less than the MTMC based rates. Table 15 shows Guaranteed Traffic Program usage by the agencies.

Table 15. Guaranteed Traffic Program

AGENCY	TOTAL SHIPMENTS	GTP SHIPMENTS	% GTP SHIPMENTS
DLA	11284	4444	39.4%
ARMY	4146	432	10.4%
NAVY	3698	1083	29.3%

The data indicates that DLA has a much higher utilization of GTP than the Army or Navy. Therefore, it is reasonable that DLA average rates would be lower based on the earlier research finding the GTP rates approximately 30% lower.[6]

[6]An interesting side note: During the research phase the GTP coordinators at DLA and Navy were asked what percentage of their agency's LTL shipments were covered under GTP. The Navy coordinator responded approximately 30% per FINS. No other Navy data was available. DLA claimed that FINS was incorrect and DLA actually had approximately

G. QUICKTRANS

Shipments moved via QUICKTRANS which are not included in FINS database were a substantial component of Navy LTL transportation. Absence of the QUICKTRANS data may be adversely affecting the cost per ton-mile data calculated by FINS and circulated by MTMC. NAVMTO provided the QUICKTRANS data for FY93 shown in Table 16.

Table 16. Navy LTL Shipments - QUICKTRANS Versus FINS

	Shipments	Cost	Weight	Avg. Wt.	Avg. Cost	Avg. Dist.
CONTRUCK	90,672	$4,982 K	26,788 K	295	$ 54.95	N/A
NDTS	58,872	$1,306 K	10,520 K	179	$ 22.17	N/A
QT TOTAL	149,544	$6,288 K	37,308 K	249	$ 42.05	N/A
FINS	105,727	$36,641 K	173,060 K	1637	$346.57	1126

QUICKTRANS provided dedicated LTL service for the Navy, consisting of CONTRUCK cross country service, and NDTS covering the northeast corridor from Norfolk, VA north to Brunswick, ME. Mileage factors are not available for QUICKTRANS, so it is difficult to make FINS comparisons. However, it should be noted that QUICKTRANS handled nearly 59% of the Navy's LTL traffic.[7] That majority of the Navy's LTL traffic is not included in FINS. Therefore, the value of the FINS data, in calculating Navy cost, is greatly diminished.

95% of its LTL shipments covered by GTP.

[7]During interviews, NAVMTO code 02B was adamant in defending QUICKTRANS costs. He explained that each month QUICKTRANS costs were compared to MTMC rates for the same routes, and QUICKTRANS' cost was always lower. QUICKTRANS was the Navy's version of a guaranteed traffic program. (Bryan, 1996)

IV. SUMMARY OF FINDINGS, CONCLUSIONS, AND RECOMMENDATIONS

A. FINDINGS

The Financial Information System database has not been fully supported by the agencies utilizing the data. In the case of the Navy, the group tasked to input the data into FINS is not a user of that data. Furthermore, it appears that Navy management groups using the FINS data have not deemed it important enough to communicate its importance to the group responsible for input. The Navy has been singled out because the researcher was able to easily communicate with numerous levels of Navy organizations. However, the data showed that DLA and Army inputs were also of poor quality.

The Navy ships far more ammunition and explosives than other agencies. These shipments cost many times the average and adversely affect the Navy ton-mile cost averages. When ammunition and explosive records were removed the Navy and Army ton-mile average costs were nearly identical, and they were much closer to DLA costs.

It seemed odd that the Navy would ship more ammunition and explosives than the Army. Discussions with senior Army personnel at MTMC Western Area shed little light on this observation. However, junior and mid-grade Army Officers with transportation company experience knew the answer right away. Discussions indicated that much Army ammunition is transported using organic assets under the training or exercise umbrella, which allows the Army to avoid the high cost commercial movement. The forgoing explanation, though not documented, certainly seems to be a plausible explanation for the Navy's higher usage of commercial ammunition and explosive shipments. Additionally, for commercial shipments, the Army utilized the cost saving dromedary mode far more frequently than the Navy.

DLA utilized the guaranteed traffic program for more than 39% of its shipments, while the Navy only used GTP 29% of the time. Considering the savings DLA found in its GTP studies, this tremendous difference in GTP usage could explain the Navy's higher ton-mile costs. The 39% DLA usage cited above is according to the FINS data. The DLA representative disputed the FINS data and claimed that more than 90% of DLA's LTL shipments are covered by Guaranteed Traffic. The Navy representative had no independent data concerning GTP, and accepted the FINS data.

In FY93 58.6% of the Navy's LTL traffic was handled under the QUICKTRANS organization including CONTRUCK and Northeast Dedicated Truck System. The QUICKTRANS shipments were not reported to FINS, and not included in the calculations. This problem should have been eliminated at the end of FY94 when QUICKTRANS ceased operations.

B. CONCLUSIONS

The sample data and associated research indicate that the Navy's ton-mile costs may not be as far out of line as the FINS calculations suggest. Navy users of FINS data should be made aware of its quality problems, and make estimates, projections, and decisions keeping FINS limitations in mind.

C. RECOMMENDATIONS

Looking ahead, the Navy needs to commit to supporting the Consolidated Freight Management program. CFM should be a valuable tool to all DOD users, however, it could become as questionable as FINS if some participants are not committed. Management must ensure that the effort is aimed at working with CFM and not focused on finding short-cuts or ways to circumvent the system. CFM may be an Army invention, but all of DOD will depend on the output. Whenever a manager is tempted to clear the desk at the expense of doing the job correctly, he

should remember that data output is never of higher quality than the input.[8] Somewhere down the line, someone will depend upon the data to make critical decisions.

Concerning recommendations for further study, it seems that the Navy should focus on the costs of shipping ammunition and explosives. Are all the shipments necessary, or could consolidation yield savings? Additionally, DLA has established the value of the guaranteed traffic program. With the loss of QUICKTRANS, the Navy should look for new opportunities to benefit from the lower GTP costs.

[8]This input / output dilemma is also known as: garbage in equals garbage out.

APPENDIX

Definitions

CWT/mile, hundred weight mile cost	The cost of transporting one hundred pounds for a distance of one mile.
LTL, or less than truck-load	A shipment of less than 10,000 pounds not requiring exclusive use of a vehicle.
Ton-mile cost	The cost to transport one ton for a distance of one mile. Ton-mile cost is calculated by dividing the total cost by the product of multiplying the shipment weight in tons by the distance in miles.
Freight, All Kinds, FAK	General cargo not specifically identified, which is shipped under a general tariff rate instead of a specific tariff for each commodity.
Ammunition and Explosives	A hazardous category of cargo which must be identified and transported by equipment and drivers certified for explosives transport, frequently requiring protective services to be furnished by the transport company.
Protective Service, PS	Additional protection for a sensitive or classified shipment provided by the transport company and paid for by the shipper or consignee. PS may include background investigation of drivers, dual drivers,

satellite surveillance, and other methods to maintain accountability of cargo.

Guaranteed Traffic, GT, GTP	A program where an agency solicits carriers for a highly favorable tariff over a specific route in return for promising that carrier all the agency's shipments over that specific route for a specific period.
Dromedary	A mini container or CONEX type container used for shipments up to 10,000 pounds where the contents cannot be mixed with general cargo. In its exclusive dromedary, certain types of cargo can be transported on the same trailer with other cargo and still maintain required separation.
Second Destination Shipments	Any shipment beyond the initial shipment from the producer or supplier into the government supply system (usually a stock point), or end-user. Second destination shipments are frequently those shipments between stock points and end-users, or between end-users. Second destination shipments are usually paid with operating funds while first destination shipments are usually included in acquisition costs. (There are exceptions.)

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